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LARVAL AND PUPAL STAGES OF A PREDACEOUS DIVING BEETLE, *NEOCLYPEODYTES CINCTELLUS* (LECONTE) (DYTISCIDAE: HYDROPORINAE: BIDESSINI)

PHILIP D. PERKINS

% Department of Entomology, NHB 169, Smithsonian Institution, Washington, D.C. 20560.

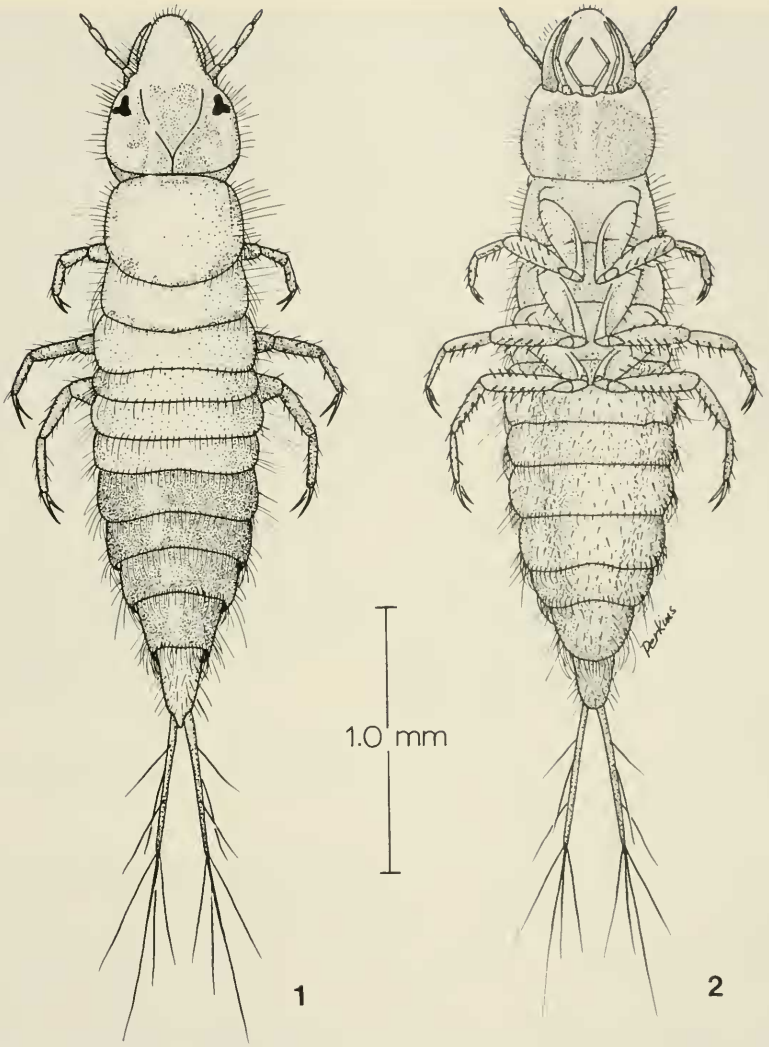
Abstract.—Larval and pupal stages of a predaceous diving beetle, *Neoclypeodytes cinctellus* (LeConte), are described and illustrated with line drawings and scanning electron micrographs. Microhabitat of the larvae, rearing techniques, and descriptions of bidessine larvae appearing in the literature are briefly discussed.

Immature stages of the tribe Bidessini (Dytiscidae: Hydroporinae) are among the most imperfectly known of predaceous aquatic Coleoptera. Of the 16 genera and 158 species in Bidessini currently recognized for the Western Hemisphere (Young, 1967, 1969, 1970, 1974, 1977), larvae of only two species and no pupae have been described. Immature stages of bidessine dytiscids from other regions of the world are also very poorly known.

Ten species of Bidessini have had the larval stage described. The species, localities, and references to these descriptions are as follows:

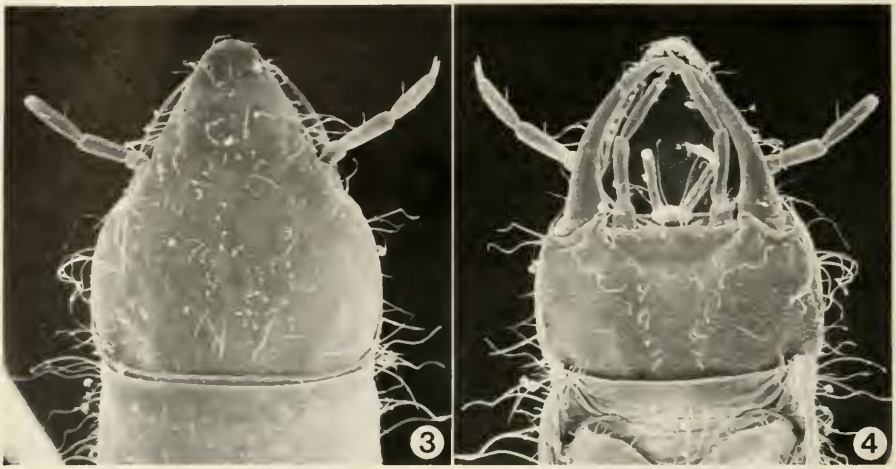
Uvarus lacustris (Say); U.S.A.; Needham and Williamson (1907).
Liodessus affinis (Say); Canada; Watts (1970).
Liodessus amabilis (Clark); Australia; Watts (1963).
Liodessus megacephalus (Gschwendtner); Japan; Satô (1968).
Guignotus japonicus (Sharp); Japan; Fukuda et al. (1959).
Guignotus pusillus (Fabricius); Europe; Bertrand (1972), Brassavola de Massa (1930).
Guignotus hamulatus (Gyllenhal); Europe; Meuche (1937).
Allodessus bistrigatus (Clark); Australia; Watts (1963).
Pachynectes ventricosus Regimbart; Madagascar; Bertrand (1972).
Yola bicarinata Latreille; France; Bertrand (1972).

These larval descriptions are, for the most part, extremely brief, and illustrations (if given) lack adequate detail from which to devise even the rudiments of a generic key to bidessine larvae. All known larvae have the



Figs. 1–2. *Neoclypeodytes cinctellus*, last-instar larva. 1, Dorsal habitus. 2, Ventral habitus.

frontal region of the head projected anteriorly to form a "nasale" (as in Fig. 5), a feature indicative of the subfamily Hydroporinae. Some larvae in the Hydroporinae have a moderately to well developed indentation on each side of the nasale, and/or have lateral projections. Bertrand (1972), in a key to the larvae of Dytiscidae, used the absence of distinct indentations and lateral projections of the nasale as key characters for the Bidessini; however, he



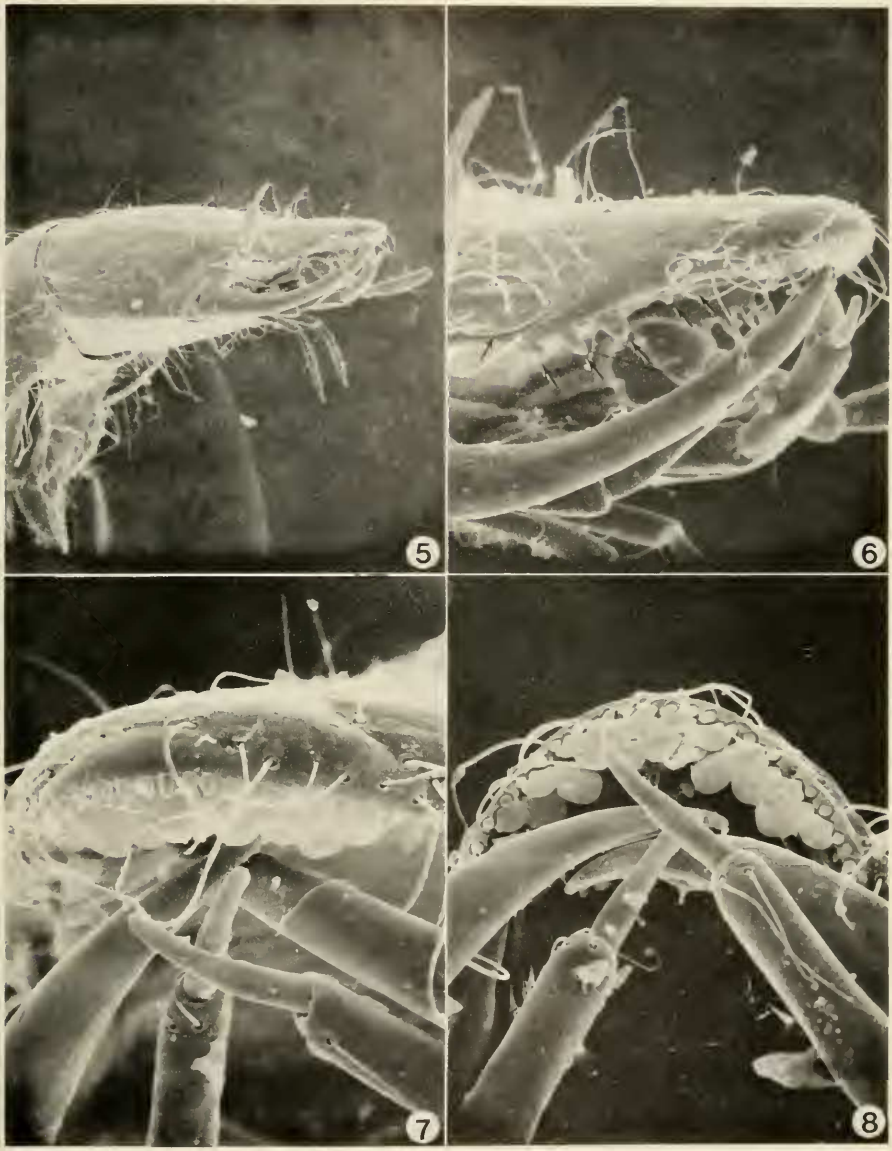
Figs. 3–4. *Neoclypeodytes cinctellus*, last-instar larva, scanning electron micrographs (125×). 3, Dorsal aspect of head. 4, Ventral aspect of head.

was unable to delineate differences between genera within the tribe (except to isolate *Yola*).

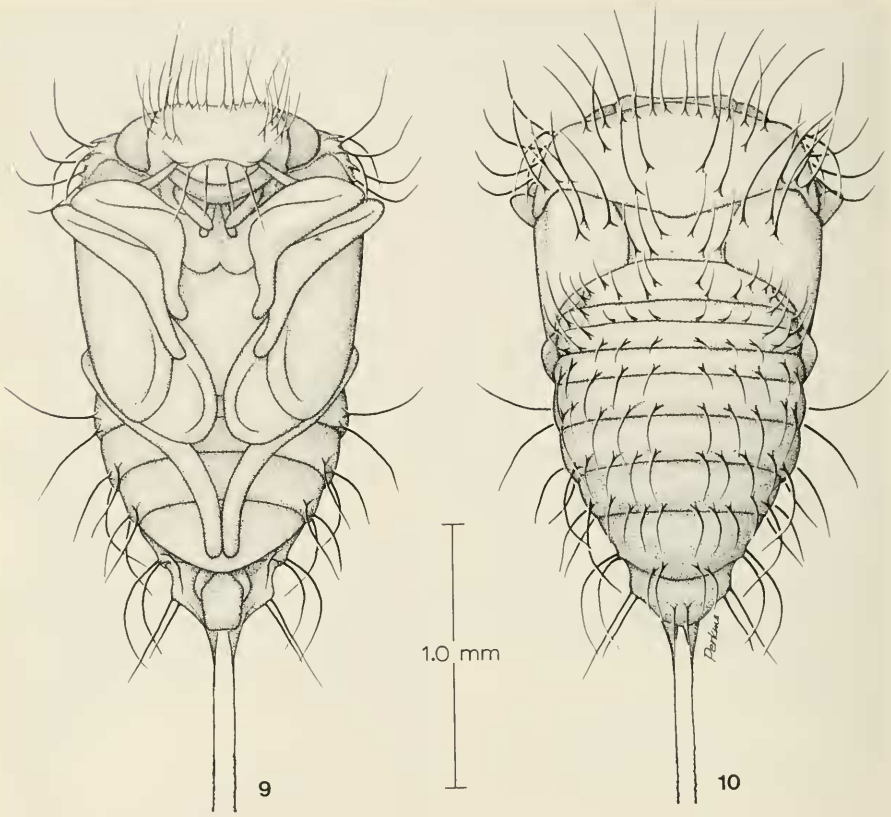
Lack of detail in existing descriptions is largely due to the small size of these insects, adults of which vary from 1.2–3.5 mm in length (Young, 1967). Also, since the larval bidessine data base lacks a comparative study of (1) a number of congeneric species, or (2) one species for a set of genera, any single species description is not adequate to determine with certainty those features of importance at the generic or specific level.

After a review of non-American bidessine adults in the British Museum (Natural History), Young (1967) found that the American species placed in the genus *Bidessus* were not congeneric with the non-American members of that genus but actually belonged to undescribed genera; consequently, he described three new genera: *Neobidessus*, *Microdessus* and *Neoclypeodytes*. Later, Young (1969) published a checklist of American Bidessini and assigned previously described species to genera. The larval and pupal stages of one of these species, *Neoclypeodytes cinctellus* (LeConte), are described below. This constitutes the first description of a *Neoclypeodytes* larva and the first Bidessini pupa. It brings the number of Bidessini genera known in the larval stage to three in America (*Uvarus*, *Liodessus*, *Neoclypeodytes*) and seven worldwide (see above).

As mentioned previously, when describing bidessine larvae it is impossible at present to select with certainty those features which are of specific or even generic significance. Since differences between genera in other tribes of Hydroporinae frequently relate to form of the nasale, this structure



Figs. 5–8. *Neoclypeodytes cinctellus*, last-instar larva, scanning electron micrographs. 5, Lateral aspect of head (120×). 6, Lateral aspect of nasale and mouthparts (400×). 7, Apex of nasale, anterior aspect (820×). 8, Apex of nasale, ventral aspect (735×).



Figs. 9–10. *Neoclypeodytes cinctellus*, pupa. 9, Ventral aspect. 10, Dorsal aspect.

has been emphasized. In *Neoclypeodytes cinctellus* the nasale has five lateral denticles, three larger and two smaller (arrows, Fig. 6). These denticles point ventrad and are not visible in dorsal view (Fig. 3). Between the first (most proximal) denticle and the antennal base is a cuticular crease (leftmost arrow, Fig. 6) which probably represents the vestige of the posterior part of the sinuation seen in non-Bidessini Hydroporinae. The apex of the nasale is armed with both peg and spatulate setae (Figs. 7–8). Although these are the most salient features of the nasale, less obvious features such as placement of setae (Figs. 3–8) may prove to be of specific or generic importance. Pigmentation patterns may also be important in differentiating larvae of *Neoclypeodytes* species. In *N. cinctellus* the dorsal and ventral surfaces of the head are distinctively patterned; even more distinctive is the dark pigmentation of abdominal terga 4–7, which contrast nicely with the testaceous color of the other abdominal and thoracic segments (Figs. 1–2).

The larval and pupal stages of *N. cinctellus* described below were reared from adults collected in Orange County, California. Adults were found in shallow water of an outwash area with sandy substratum. Adults were placed in an aquarium which had 8.0 cm of sand. Last-instar larvae were seen moving with great agility in the interstices between sand grains beneath the surface of the sand. Some larvae were seen as much as 3.0 cm below the sand's surface. The more slender body form of the larvae may allow them to penetrate deeper into the substratum than the more robust adults, thereby permitting them to exploit a different microhabitat and also to prevent predation of adults upon larvae. According to Young (1967), the Bidessini show varying ecological modifications, but as a whole "occupies the very small aquatic predator niche in the marginal zone and psammon of freshwater." Eggs, oviposition sites, and larval instars other than the last were not observed.

The general technique of obtaining pupae from reared aquatic beetle larvae is to place soil (sand, sphagnum, etc.) around the vessel containing the larvae, and provide the larvae a means of access to the soil where pupation occurs. When working with such tiny larvae as bidessines, however, this method presents a problem as the small pupae can be easily destroyed when picking through the soil, or simply not found. To circumvent this problem, *N. cinctellus* last-instar larvae were placed in a small plastic container (about 2.5 cm square) with about 1.5 cm of water. A small, flat piece of cork which had a section of string attached was then floated on the water's surface, with the string dangling to the bottom of the container. The larvae eventually climbed up the string and pupated on the upper surface of the cork.

Neoclypeodytes cinctellus (LeConte)
Figs. 1–10

Last-instar larva.—Length (including cerci) 4.0 mm; greatest width (at second abdominal segment) 0.63 mm. Color of head testaceous with brownish pattern on dorsal and ventral surface as illustrated (Figs. 1–2); ocelli black; legs and remainder of body testaceous except abdominal terga 4–7, which are dark brown.

Head with anterior region prolonged to form nasale; vertex with Y-shaped ecdysial cleavage line; posterior margin of dorsum with a transverse sulcus (Figs. 3, 5). Nasale in dorsal view lacking lateral indentations, spines, or strongly produced areas; however, a small, very weakly produced area exists near antennal bases (Figs. 3, 5; leftmost arrow, Fig. 6). Nasale in lateral view with 5 denticles at lateral margin (arrows, Fig. 6); posterior 3 denticles larger than anterior 2. Apex of nasale with peg and spatulate setae as illustrated (Figs. 7, 8). Setal patterns of dorsal, ventral, and lateral regions of head as illustrated (Figs. 3, 8). Ventral surface of head alutaceous (Fig. 4).

Antenna cylindrical, 4-segmented; segments 1 and 4 short, subequal in

length; segments 2 and 3 longer, subequal in length, each nearly 3× length of segments 1 and 4. Segment 3 with 2 stout setae (Fig. 4), other segments lacking setae.

Mandible falciform, slender, curved inward and upward apically; a row of very shallow impressions near base (Figs. 5–6). Maxilla with stipes slightly longer than wide; stipes with 3 flagelliform setae ventrally (Fig. 4). Maxillary palpus slender, 4 segmented; basal segment very short, about 1/6 length of 2nd; segments 2 and 3 elongate, subequal in length; segment 4 short, about 1/3 length of segment 3; segment 3 with 2 apicoventral flagelliform setae (Fig. 8). Labium small, subtriangular, with flagelliform setae (Fig. 4); ligula absent. Labial palpi slender, elongate, 2 segmented, segments subequal in length; apical segment directed ventrad (Fig. 5).

Pronotum subquadrate, with numerous lateral, posterior, and dorsal setae (Figs. 1, 3, 5). Mesonotum slightly wider than and less than ½ as long as pronotum, with setae on lateral and posterior margins. Metanotum about as long as mesonotum, slightly wider; setae on lateral and posterior margins.

Legs 5 segmented; coxa long, subequal in length to femur, slightly shorter than tibia and tarsus combined; tarsus with 2 slender claws. Prominent setae of legs as illustrated (Figs. 1, 2).

Abdomen 8 segmented, arching dorsally. Segments 1–6 with dorsal sclerites; segments 7 and 8 completely sclerotized, ringlike. Prominent setae of abdomen as illustrated (Figs. 1, 2). Segment 8 produced at apex, with 2 cerci. Cerci long, subequal to length of abdomen; cercus with 3 equidistant lateral and 4 apical setae.

Pupa.—Length including setae of head and cerci, 3.0 mm; length excluding setae, 2.0 mm. Color white, eyes darker.

Head with a total of 23 setae near eyes and vertex; 4 long setae on anterior clypeal margin.

Pronotum with long, stiff setae arranged as follows: 6 on lateral margins, 4 of which are directed dorsally and 2 posteriorly; 3 at posterolateral angles; 3 submedially; 6 in a row at anterior margin. Mesonotum and metanotum each with 12 setae as illustrated (Fig. 10).

Abdominal segment 1 with 5 setae on each side; segment 2 with 7 setae on each side; segment 3 with 5 setae on each side; segments 4–6 each with 7 setae on each side, 2 of which are longer, stiffer, and placed lateroventrally; segment 7 with 2 dorsal pairs, 2 lateral pairs, and 1 ventral pair of setae; segment 8 with 1 dorsal pair and 2 lateral pairs of setae. Cerci with long setae, apical regions roughly textured. The specimen illustrated (Fig. 9) is apparently a male, judging from the shape of the median structure of segment 8.

Acknowledgments

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